

## CAVEATS: Some of excuse's

The label "PROBLEM" does not always mean exercise; if no solution is given, it means we couldn't solve it. If you solve a problem in here, let us know.

Unless otherwise stated, all computer programs are in **assembly language**.

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# HAKMEM

Compiled with the hope that a record of the random things people do around here can save some duplication of effort -- except for fun.

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Here is some little known data which may be of interest to computer hackers. The items and examples are so sketchy that to decipher them may require more sincerity and curiosity than a non-hacker can muster. Doubtless, little of this is new, but nowadays it's hard to tell. So we must be content to give you an insight, or save you some cycles, and to welcome further contributions of items, new or used.

The classification of items into sections is even more illogical than necessary. This is because later elaborations tend to shift perspective on many items, and this elaboration will (hopefully) continue after publication, since this text is retained in "machinable" form. We forgive in advance anyone deterred by this wretched typography.

CAVEATS: Some of this material is very inside -- many readers will have to excuse cryptic references. page 2

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PUSHJ P,.+1 is a nice way to have something happen twice. Other useful angle multiplying formulas are  $\tanh x = (2 \tanh x/2) / (1 + (\tanh x/2)^2)$  and  $\tan x = (2 \tan x/2) / (1 - (\tan x/2)^2)$ , if infinity is handled correctly. For cos and cosh, one can use

# Inventing interactive programming

The TX-0 computer was built in 1956. The control panel included Toggle Switch Storage for setting sixteen 18-bit registers, a 12 1/2" CRT screen and a teletype terminal.

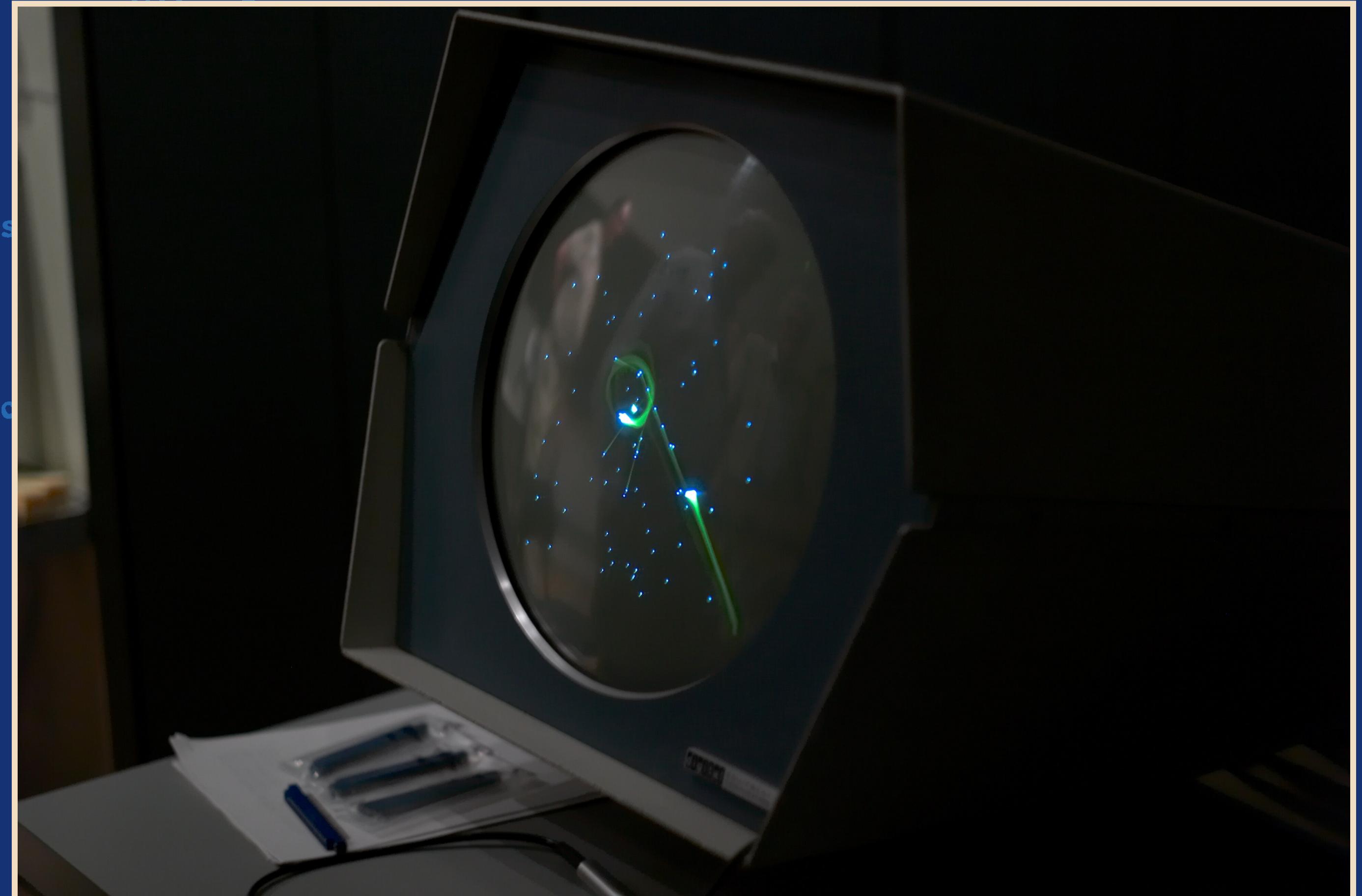
TX-0 was available for interactive use, attracting MIT hackers who built the first on-line debugging tool, letting them view and change the state of a running program.

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program execution. Hackers like  
People referred to are  
from the A.I. Lab:  
Marvin Minsky  
Bill Gosper  
Mike Hearn  
Rich Schroeppel  
Michael Sprecher  
Gerald Sussman  
Joe Cohen  
David Waltz  
David Silver  
John Roe  
Richard Stallman  
Jerry Freiberg



# NUMBER THEORY, PRIMES, PROBABILITY

## Just having fun

## 28 (Schroepel): Spacewar! was

Spacewar! was an interactive game built by a group of MIT hackers in 1962 to showcase the capabilities of the TX-0 computer successor PDP-1.

Squeezing a realistic star map and gravity into 4k 18-bit words required ingenuity—spaceship rendering even used a kind of just-in-time compilation.

A black and white photograph of a man in a white lab coat and glasses working at a control console. He is seated in a swivel chair, facing a large panel of instruments and displays. The panel includes a digital display showing 'COUNT' and 'CUMULATIVE SUM OF COUNT', a 'TX-0 COMPUTER' label, and a 'MARGINAL CHECK PAGE' section. The man is looking down at the console, possibly at a keyboard or a small screen. In the background, another person is visible near a wall with various equipment and displays. The setting appears to be a scientific or industrial control room from the mid-20th century.